

WE CLAIM:

1. A purified and isolated nucleic acid molecule comprising a sequence encoding a transferrin binding protein of *P. haemolytica*.
2. A purified and isolated nucleic acid molecule according to claim 1 comprising a sequence 5 encoding TbpA of *P. haemolytica*.
3. A purified and isolated nucleic acid molecule as claimed in claim 2, which encodes a protein having the amino acid sequence as shown in Figure 22 and SEQ ID NO:2.
4. A purified and isolated nucleic acid molecule as claimed in claim 2, having a sequence which comprises (a) a nucleic acid sequence as shown in Figure 21 and SEQ ID NO:1 (b) nucleic acid sequences complementary to (a); (c) nucleic acid sequences which are at least 80% homologous to (a); or (d) a fragment of (a) or (b) that is at least 15 bases and which will hybridize to (a) or (b) under stringent hybridization conditions.
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5. A purified and isolated nucleic acid molecule according to claim 1 comprising a sequence encoding TbpB of *P. haemolytica*.
- 15 6. A purified and isolated nucleic acid molecule as claimed in claim 5, which encodes a protein having the amino acid sequence as shown in Figure 24 and SEQ ID NO:4.
7. A purified and isolated nucleic acid molecule as claimed in claim 5, having a sequence which comprises (a) a nucleic acid sequence as shown in Figure 23 and SEQ ID NO:3; (b) nucleic acid sequences complementary to (a); (c) nucleic acid sequences which are at least 80% 20 homologous to (a); or (d) a fragment of (a) or (b) that is at least 15 bases and which will hybridize to (a) or (b) under stringent hybridization conditions.
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8. A naturally occurring nucleic acid molecule which is characterized by the ability to hybridize to the purified and isolated nucleic acid molecule as claimed in claim 2 under stringent hybridization conditions.
from *Ps. speciosa haemolytica*
- 25 9. A naturally occurring nucleic acid molecule which is characterized by the ability to hybridize to the purified and isolated nucleic acid molecule as claimed in claim 5 under stringent hybridization conditions.

10. An oligonucleotide comprising at least 15 contiguous bases of a nucleic acid molecule as claimed in claim 2 which is characterized by the ability to hybridize to the nucleic acid molecule under stringent hybridization conditions.
11. An oligonucleotide comprising at least 15 contiguous bases of a nucleic acid molecule as claimed in claim 5 which is characterized by the ability to hybridize to the nucleic acid molecule under stringent hybridization conditions.
12. A recombinant expression vector adapted for transformation of a host cell comprising a nucleic acid molecule as claimed in claim 2 and one or more transcription and translation elements operatively linked to the nucleic acid molecule.
- 10 13. A recombinant expression vector adapted for transformation of a host cell comprising a nucleic acid molecule as claimed in claim 5 and one or more transcription and translation elements operatively linked to the nucleic acid molecule.
14. A host cell containing a recombinant expression vector as claimed in claim 12.
15. A host cell containing a recombinant expression vector as claimed in claim 13.
- 15 16. A purified and isolated TbpA protein.
17. A purified and isolated TbpA protein as claimed in claim 16, which has the amino acid sequence as shown Figure 22 and SEQ ID NO:2, or fragments thereof capable of binding transferrin.
18. A purified and isolated TbpB protein.
- 20 19. A purified and isolated TbpB protein as claimed in claim 18, which has the amino acid sequence as shown in Figure 24 and SEQ ID NO:4, or fragments thereof capable of binding transferrin.
- 25 20. A method for preparing a TbpA protein comprising (a)transferring the recombinant expression vector according to claim 12 into a host cell; (b) selecting transformed host cells from untransformed host cells; (c) culturing a transformed host cell under conditions which allow expression of TbpA ; and (d)isolating the recombinant TbpA.

21. A method for preparing a TbpB protein comprising (a)transferring the recombinant expression vector according to claim 13 into a host cell; (b) selecting transformed host cells from untransformed host cells; (c) culturing a transformed host cell under conditions which allow expression of TbpB ; and (d)isolating the recombinant TbpB.
- 5 22. A polyclonal or monoclonal antibody having specificity against an epitope of TbpA or TbpB.
- 14 23. A vaccine for the prophylaxis and treatment of an infection caused by a Pasteurella spp., wherein said vaccine comprises an immunologically effective amount of at least one of TbpA and TbpB of *P. haemolytica* and a pharmaceutically acceptable carrier.
- 10 24. The vaccine according to claim 23 wherein said infection is caused by *Pasteurella haemolytica*.
25. A vaccine for the prophylaxis and treatment of an infection caused by a Pasteurella spp., wherein said vaccine comprises an immunologically effective amount of TbpA and TbpB and a pharmaceutically acceptable carrier.
- 15 26. A vaccine for the prophylaxis and treatment of an infection caused by a Pasteurella spp., wherein said vaccine comprises an immunologically effective amount of TbpB and a pharmaceutically acceptable carrier.
- ✓ 27. The vaccine according to claim 26 wherein said TbpB has the amino acid sequence as shown in Figure 24 and SEQ ID NO:4.
- 20 28. A vaccine for the prophylaxis and treatment of an infection caused by a Pasteurella spp., wherein said vaccine comprises an immunologically effective amount of a recombinant expression vector according to claim 12 and a pharmaceutically acceptable carrier.
29. A vaccine for the prophylaxis and treatment of an infection caused by a Pasteurella spp., wherein said vaccine comprises an immunologically effective amount of a recombinant expression vector according to claim 13 and a pharmaceutically acceptable carrier.

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